4 SEM TDC PHYH (CBCS) C 8

2022

(June/July)

PHYSICS

(Core)

Paper : C-8

(Mathematical Physics—III)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct option : 1×4=4

(a) If z_1 and z_2 are two complex numbers, then

(i) $|z_1 + z_2| \geq |z_1| - |z_2|$

(ii) $|z_1 + z_2| \leq |z_1| - |z_2|$

(iii) $|z_1 + z_2| \leq |z_1| - |z_2| + |z_1 z_2|$

(iv) $|z_1 + z_2| \leq |z_1| + |z_2| + |z_1 z_2|$

(b) The function $f(z)=\frac{1}{(z-2)^3}$ has a/ an _____ at $z=2$.

(i) essential singularity
(ii) pole
(iii) branch point
(iv) None of the above

(c) The Laplace transform $f(s)$ of $F(t)=t$ is

(i) 1 (ii) s
(iii) s^2 (iv) $1/s^2$

(d) If $g(\omega)$ is the Fourier transform of $f(t)$, then the Fourier transform of $f(at)$ is

(i) $\frac{1}{a}g\left(\frac{\omega}{a}\right)$

(ii) $\frac{1}{\omega}g\left(\frac{\omega}{a}\right)$

(iii) $\frac{1}{\omega}g\left(\frac{a}{\omega}\right)$

(iv) None of the above

2. (a) Find the polar form of $-5+5i$. 2

(b) Find the residue of the function

$$f(z)=\frac{z}{(z-1)(z+1)^2}$$ 2

(c) Show how Cauchy's theorem can be used for a multiply connected region. 2

(d) Show that the Fourier transform of the derivative of $f(t)$ is $i\omega g(\omega)$, where $g(\omega)$ is the Fourier transform of $f(t)$. 2

(e) Prove that if $f(s)$ is the Laplace transform of $F(t)$, then the Laplace transform of $F(at)$ is

$$\frac{1}{a}f\left(\frac{s}{a}\right)$$ 2

3. (a) What are the different types of singularities of a complex function? Locate and name the singularities of

$$f(z)=\frac{z^8+z^4+2}{(z-1)^3(3z+2)^2}$$ 2+3=5

(b) Prove Cauchy-Riemann equations in polar coordinates. 4

Or

If $f(z)$ is an analytic function of z, then prove that

$$\left(\frac{\partial}{\partial x^2}+\frac{\partial}{\partial y^2}\right)|f(z)|^2=4|f'(z)|^2$$ 4

(c) State the Cauchy's integral formula. Evaluate

$$\oint_C \frac{\sin\pi z^2+\cos\pi z^2}{(z-1)(z-2)}dz$$

where C is the circle $|z|=1$. 1+4=5

(d) Find the value of

$$\int_C \frac{\sin^6 z}{\left(z-\frac{\pi}{6}\right)^3} dz$$

where C is the circle $|z|=1$. 4

(e) Express the following function in a Laurent's series : 3

$$f(z)=\frac{1}{(z+1)(z+3)}$$

4. Find the Fourier transform of the following functions (any *two*) : 3×2=6

(i) $e^{-|t|}$

(ii) $Ne^{-\alpha x^2}$ (N and α are constants)

(iii) e^{-r^2/a^2} (a is a constant and $r=\sqrt{x^2+y^2+z^2}$)

5. Find the Laplace transform of the following functions (any *two*) : 3×2=6

(i) $t^2e^t \sin 4t$

(ii) $e^{at}\cos\omega t$

(iii) t^n

6. Write short notes on the following (any *two*) : 3×2=6

(a) Cauchy's theorem

(b) Laplace transforms and its applications

(c) Parseval's theorem

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Total No. of Printed Pages—4

4 SEM TDC PHYH (CBCS) C 9

2022

(June/July)

PHYSICS

(Core)

Paper : C–9

(Elements of Modern Physics)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following : 1×5=5

(a) The photocurrent depends on

(i) frequency of the incident radiation

(ii) intensity of the incident radiation

(iii) Both *(i)* and *(ii)*

(iv) None of the above

(b) The size of the nucleus of an atom of mass number A is proportional to

(i) $A^{3/4}$ (ii) $A^{2/3}$

(iii) $A^{1/3}$ (iv) A

(c) The energy eigenvalue of a particle in one-dimensional box of infinite depth is proportional to

(i) n^2

(ii) n

(iii) $n^{1/2}$

(iv) None of the above

(d) The rate of spontaneous emission is proportional to

(i) the number of atoms in the higher energy state

(ii) the number of atoms in the lower energy state

(iii) Both (i) and (ii)

(iv) None of the above

(e) Gamma radiations are

(i) deflected by magnetic field only

(ii) deflected by electric field only

(iii) deflected by both electric field and magnetic field

(iv) None of the above

2. Answer the following questions : 2×5=10

(a) What is blackbody radiation? State the Planck's theory of blackbody radiation.

(b) What is population inversion? Write at least two methods for achieving population inversion.

(c) Why is it impossible for an electron to be present inside the nucleus?

(d) State de Broglie's hypothesis and write down the expression for de Broglie wavelength.

(e) State the law of radioactive decay. What is half-life period of a radioactive substance?

3. (a) State the Heisenberg's uncertainty principle. Obtain the minimum energy of a particle confined in a one-dimensional box using uncertainty principle. 1+2=3

(b) A wave function is given by

$$\psi(x) = A_n \sin\frac{2n\pi x}{L}$$

in the region $0 \le x \le L$. Find the value of A_n using normalization condition. 3

(c) Differentiate between nuclear fission and nuclear fusion. What do you mean by mass deficit? 2+1=3

4. *(a)* Write down the time-independent and time-dependent forms of Schrödinger equation for non-relativistic particles. What are energy and momentum operators? 2+2=4

(b) Show that $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$, where the symbols have their usual meanings. 4

Or

How is the probability of a particle related with its wave function? Obtain an expression for the probability current density. 1+3=4

5. *(a)* Explain Compton scattering and obtain an expression for the Compton shift. 6

(b) Explain the quantum mechanical tunneling for a particle across a rectangular potential barrier and obtain the expression for transmission coefficient. 6

(c) Give a brief description of the α-decay, β-decay and γ-ray emission with examples. 2×3=6

6. Write a short note on any *one* of the following : 3

(a) Gamma-ray microscope experiment

(b) Nuclear shell model

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Total No. of Printed Pages—7

4 SEM TDC PHYH (CBCS) C 10

2022

(June/July)

PHYSICS

(Core)

Paper : C–10

(Analog Systems and Applications)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer : 1×5=5

(a) When reverse bias is applied to a junction diode

(i) width of depletion layer decreases

(ii) potential barrier increases

(iii) potential barrier decreases

(iv) minority carrier increases

(b) The rectification efficiency of full-wave rectifier is _____ of half-wave rectifier.

(i) equal

(ii) half

(iii) double

(iv) 1·21 times

(c) Quiescence is a state of

(i) activity

(ii) inactivity

(iii) amplification

(iv) switching

(d) In a transistor amplifier, the input impedance should be

(i) low

(ii) high

(iii) negligible

(iv) None of the above

(e) Which of the following electrical characteristics is not exhibited by an ideal OP-AMP?

(i) Infinite voltage gain

(ii) Infinite bandwidth

(iii) Infinite output resistance

(iv) Infinite slew rate

2. (a) Explain how depletion layer is formed under unbiased situation of a *p-n* junction diode. 3

(b) Explain the current flow mechanism in forward and reverse biased *p-n* junction diode. 4

Or

Define the mobility of charge carriers and conductivity. Obtain an expression for the electrical conductivity of an intrinsic semiconductor. 1+3=4

3. *(a)* Explain with circuit diagram, the Zener diode as a voltage regulator. 3

(b) Describe the working of LED. 2

4. *(a)* Draw the C-E circuit of a transistor. Sketch its output characteristics. Explain the active, cut-off and saturation regions. 1+1+2=4

(b) Define α and β of a transistor. Write the relation between them. 2

5. *(a)* Draw a voltage-divider bias circuit and derive an expression for its stability factor. 4

Or

A germanium transistor with $\beta = 100$ is to be operated as a C-E amplifier with fixed bias method. The transistor operates at the signal collector current $I_C = 1$ mA and $V_{CE} = 4$ V. If a load resistance of 2 kΩ is connected in the collector circuit, then find the base resistance to be connected. (For germanium transistor $V_{BE} = 0 \cdot 3$ V)

(b) Draw the small signal hybrid equivalent circuit of a common-emitter transistor amplifier and derive the expressions for current gain and input impedance. 4

Or

Explain class *A*, class *B* and class *C* amplifiers with graphical representation.

6. Draw and discuss the frequency response curve of an *R-C* coupled transistor amplifier showing cut-off frequencies and the bandwidth. 3

7. Discuss the effect of negative feedback on the input and output impedances of an amplifier. 3

8. State Barkhausen's criterion and explain the conditions that must be satisfied for feedback amplifier to produce steady oscillations. 1+2=3

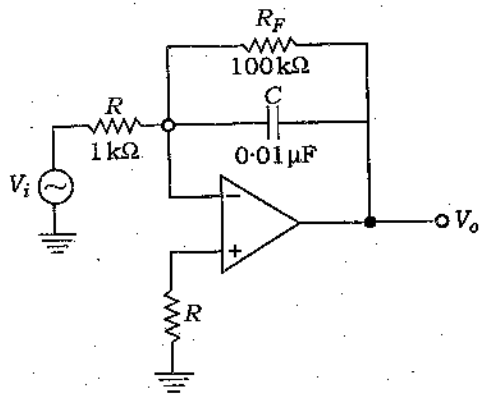
Or

Draw circuit diagram of an *R-C* phase shift oscillator and explain its operation. 3

9. *(a)* What is an OP-AMP? Draw the schematic block diagram of basic OP-AMP. 1+2=3

(b) Explain with circuit diagram, the adder and subtractor using OP-AMP. 4

(c) Determine the lower frequency limit (critical frequency) for the integrator circuit shown below : 3



Or

Discuss OP-AMP as log amplifier.

(Continued)

10. Draw the block diagram of successive approximation type A/D converter. 3

Or

Draw the circuit diagram of weighted resistor type D/A converter.

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4 SEM TDC BOTH (CBCS) C 8

2022

(June/July)

BOTANY

(Core)

Paper : C–8

(Molecular Biology)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer of the following : 1×5=5

(a) Hydrogen bonding in DNA occurs between the—Bases/Deoxyribose sugars/ Ribose sugars/Phosphate molecules.

(b) Enzyme necessary for transcription is—DNA polymerase/RNA polymerase/ RNA ase/Endonuclease.

(c) The functional unit of gene which specifies synthesis of one polypeptide is known as—Racon/Muton/Codon/Cistron.

(d) Initiation codon in higher plants is—UAG/AUG/AGU/GUA.

(e) The term 'gene' was given by—T. H. Morgan/Mendel/W. L. Johannsen/Hugo de Vries.

2. Write briefly on the following : 4×3=12

(a) Central dogma

(b) RNA priming

(c) DNA denaturation and renaturation

3. Define genetic material and briefly describe its properties. Describe any one experiment which clearly showed that DNA is the genetic material. 1+3+8=12

Or

How Watson and Crick modify the view regarding the chemical nature of gene? Give an account of the double-helix structure of DNA with the help of suitable diagram. 3+7+2=12

4. "DNA replication is semi-conservative and bidirectional." Discuss the experimental evidence in favour of this statement. 12

Or

Write explanatory notes on the following : 6×2=12

(a) DNA polymerase—I

(b) Rolling circle replication

5. Define Operon. Explain the operon model of gene regulation using lac operon of *E. coli* as an example. 2+10=12

Or

Describe the mechanism of protein synthesis in a prokaryote cell and point out the role of the different RNAs in this process. 12

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4 SEM TDC BOTH (CBCS) C 9

2022

(June/July)

BOTANY

(Core)

Paper : C–9

(Plant Ecology and Phytogeography)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following alternatives : 1×5=5

(a) Transition zone between two vegetations is known as

(i) ecotone

(ii) ecotype

(iii) ecosystem

(iv) ecocline

(b) Last stabilized community in plant succession is called

(i) pioneer community

(ii) climax community

(iii) seral community

(iv) ecosere

(c) The water held tightly in a thin film by the soil particles is known as

(i) capillary water

(ii) runaway water

(iii) hygroscopic water

(iv) gravitational water

(d) Reduced leaves and sunken stomata are the characteristic feature of

(i) epiphytes

(ii) hydrophytes

(iii) mesophytes

(iv) xerophytes

(e) If the stronger partner is benefited and the weak partner is damaged it is known as

(i) amensalism

(ii) symbiosis

(iii) predation

(iv) allotropy

2. Write short notes on any *three* of the following : 4×3=12

(a) Homeostasis

(b) Ecological importance of water

(c) Commensalism

(d) Edge effect

(e) Continental drift

3. Define plant succession. Describe the causes and types of plant succession. 2+4+6=12

Or

Write explanatory notes on the following : 6×2=12

(a) Hydrological cycle

(b) Ecological speciation

4. Define ecosystem. Write about the structure and function of an ecosystem. Mention precisely the effect of human activity on forest ecosystem. 1+3+5+3=12

Or

What is biogeochemical cycle? Describe the nitrogen cycle with appropriate sketches. Write the importance of nitrogen cycle. 1+6+3+2=12

5. What are the objectives of phytogeography? Describe the phytogeographical region of India. 4+8=12

Or

Write notes on the following : 6×2=12

(a) Endemism

(b) Factors affecting distribution of species

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4 SEM TDC BOTH (CBCS) C 10

2022

(June/July)

BOTANY

(Core)

Paper : C–10

(Plant Systematics)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. *(a)* Choose the correct answer from the following alternatives : 1×3=3

(i) The author of *Flora of British India* is Carolus Linnaeus/Sir J. D. Hooker/Kanjilal et al.

(ii) The inflorescence of Marigold is corymb/umbel/capitulum.

(iii) The unbranch, erect, cylindrical stout stem is known as aerial stem/culm/caudex.

(b) Fill in the blanks : 1×2=2

(i) The term 'taxon' was first used by _____.

(ii) When anthers as well as filaments of stamens are united, it is called _____.

(c) Write short notes on the following (any *five*) : 2×5=10

(i) Verticillaster inflorescence

(ii) Syngenesis

(iii) Monotypic genus

(iv) Biological species

(v) Monograph

(vi) ICN

2. Write notes on the following (any *three*) : 4×3=12

(a) Palynology

(b) Virtual herbarium

(c) Functions of botanical garden

(d) Typification

(e) Single-access key

3. What is cytotaxonomy? Discuss, how cytological data helps in plant taxonomy. 2+6=8

Or

Write morphological characters and economic importances of the following families : 4×2=8

(a) Lamiaceae

(b) Orchidaceae

4. By mentioning its merits and demerits, discuss Bentham and Hooker's system of classification. 4+6=10

Or

Write notes on the following : 5×2=10

(a) Merits and demerits of Engler and Prantl's system of classification

(b) APG III system of classification

5. Why can angiosperms be considered as highest evolved plants? Discuss the Gnetales-Angiosperms theory of evolution of angiosperms. 2+6=8

Or

Write short notes on the following : 4×2=8

(a) Numerical taxonomy

(b) E-flora

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4 SEM TDC ZOOH (CBCS) C 8

2022

(June/July)

ZOOLOGY

(Core)

Paper : C–8

(Comparative Anatomy of Vertebrates)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Fill in the blanks of the following : 1×5=5

(a) Horn is a derivative of _____.

(b) Teeth are absent in _____.

(c) Cutaneous respiration is found in _____.

(d) _____ pairs of cranial nerves are found in fishes.

(e) Urinary bladder is absent in _____.

2. Prepare notes of any two of the following : 5×2=10

(a) Succession of kidney in mammals

(b) Types of uteri in mammals

(c) Visual receptors in man

3. Discuss the derivatives of integument in mammals. 5

Or

Discuss the functions of integument.

4. Discuss the types of dentition in different groups of animals. 6

5. Write about the accessory respiratory organs in fish. 8

Or

Compare and contrast the pectoral girdle of bird and mammal.

6. Enlist the similarities and dissimilarities of brain in Amphibia and Mammalia with labelled diagram. Add a brief note on cranial nerves in mammals. 8+3=11

Or

Write the comparative account on the alimentary canal of man with suitable diagram. Add a brief note on digestive gland in fishes. 8+3=11

7. Compare the heart of reptiles and mammals or reptiles and birds with suitable illustrations. 8

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4 SEM TDC ZOOH (CBCS) C 9

2022

(June/July)

ZOOLOGY

(Core)

Paper : C–9

(Animal Physiology : Life Sustaining Systems)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Fill in the blanks with appropriate words : 1×5=5

   (a) Renin helps in digestion of _____.

   (b) α-units of haemoglobin are composed of _____ of amino acids.

   (c) The basic functional unit of kidney is _____.

   (d) _____ prevents the process of clotting of blood.

   (e) Major portion of CO_2 is transported as _____ in human body.

2. Write briefly on any *two* of the following : 4×2=8

(a) Carbon monoxide poisoning

(b) Tubular reabsorption

(c) Cardiac cycle

(d) Regulation of heartbeat

3. Answer any *two* of the following : 4×2=8

(a) Write a note on hormonal control of gastrointestinal tract.

(b) Write about the different components of blood and their functions.

(c) Write about the regulation of acid-base balance.

Or

What do you mean by absorption? Describe the process of absorption of carbohydrate and proteins. 2+3+3=8

4. Describe about the oxygen dissociation curves and factors influencing it. 4+4=8

Or

Describe the mechanism of O_2 and CO_2 transport by blood. What do you mean by respiratory pigment? 6+2=8

5. Describe the origin and conduction of cardiac impulse. What is coronary circulation? 6+2=8

Or

Write about the Frank-Starling law of the Heart. Describe the nervous and chemical regulation of heart rate. 2+3+3=8

6. Answer briefly the following : 4×2=8

(a) Write a note on structure and functions of haemoglobin.

(b) Draw and describe the histology of lung.

Or

Write about the process of clotting of blood. 8

7. Illustrate with a suitable diagram, the structure of a nephron. Discuss about the mechanism of urine formation. 4+4=8

Or

What is the functional unit of kidney? Discuss about the regulation of acid-base balance. 1+7=8

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4 SEM TDC ZOOH (CBCS) C 10

2022

(June/July)

ZOOLOGY

(Core)

Paper : C–10

(Biochemistry of Metabolic Process)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Fill in the blanks of the following : 1×5=5

(a) The net gain of ATP during the conversion of one glucose molecule to pyruvate is _____ ATP molecules.

(b) The breakdown of _____ is often coupled with the metabolic reactions of biosynthesis and breakdown.

(c) _____nos. of ATPs are formed during complete oxidation of a palmitate molecule.

(d) The process of conversion of amino acids to alpha-keto acids is called _____.

(e) In electron transport, electrons ultimately pass to _____.

2. Explain precisely on any *two* of the following : 4×2=8

(a) Definition of coupled reaction with example

(b) Pyruvate dehydrogenase complex

(c) ATP as energy currency of cell

(d) Inhibitors of respiratory chain

3. Write short notes on any *two* of the following : 4×2=8

(a) Malate—aspertate shuttle

(b) Gluconeogenesis

(c) Oxidative deamination

(d) ATP synthase

4. What is TCA cycle? Describe briefly the reactions of TCA cycle with its energetics. 1+7=8

Or

Describe the pentose phosphate pathway of carbohydrate metabolism and write its significance. 6+2=8

5. What is Beta oxidation? Describe the mechanism of Beta oxidation of fatty acid. 2+6=8

Or

What is ketogenesis? Describe the reaction pathway of ketogenesis. 2+6=8

6. Describe the process of urea biosynthesis and write the significance of the urea cycle. How is urea cycle linked with TCA cycle? 4+2+2=8

Or

What is transamination? Describe the mechanism of transamination and its significance. 2+6=8

7. What is ETC? Explain the structural components ETC in mitochondria. 2+6=8

Or

Distinguish oxidative phosphorylation and substrate-level phosphorylation. Write about the Chemi-osmotic theory. 3+5=8

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4 SEM TDC MTMH (CBCS) C 8

2022

(June/July)

MATHEMATICS

(Core)

Paper : C–8

(Numerical Methods)

Full Marks : 60
Pass Marks : 24

Time : 3 hours

The figures in the margin indicate full marks for the questions

Use of scientific calculator is allowed

1. *(a)* Write True or False : 1

An exact number may be regarded as an approximate number with error zero.

(b) Define round-off error and truncation error. 1+1=2

(c) The number $x = 37 \cdot 46235$ is rounded off to four significant figures. Compute the absolute error and relative error. 1+1=2

2. (a) Write True or False : 1

A transcendental equation may have no roots.

(b) Find a real root of the equation $x^3 - 3x + 1 = 0$ by the method of bisection correct up to three decimal places. 4

Or

Find a real root of the equation $x^3 - x - 10 = 0$ by the method of secant, correct up to three decimal places.

(c) Describe Newton's method for solution of an algebraic equation. 5

Or

Determine the real root of $2x - 3\sin x - 5 = 0$ by Newton's method correct up to three decimal places.

3. (a) Solve

$$x_1 + x_2 - x_3 = 2$$
$$2x_1 + 3x_2 + 5x_3 = -3$$
$$3x_1 + 2x_2 - 3x_3 = 6$$

by Gaussian elimination method. 5

Or

Find the solution of the system

$$83x + 11y - 4z = 95$$
$$7x + 52y + 13z = 104$$
$$3x + 8y + 29z = 71$$

by Gauss-Seidel method (obtain three iterations).

(b) Describe Gauss-Jordan method. 5

Or

Solve by Gauss-Jacobi method

$$5x + 2y + z = 12$$
$$x + 4y + 2z = 15$$
$$x + 2y + 5z = 20$$

4. (a) Show that $\Delta - \nabla = \Delta\nabla$. 1

(b) Deduce Lagrange's interpolation formula. 5

(c) Applying Newton's interpolation formula, compute $\sqrt{5 \cdot 5}$ (given that $\sqrt{5} = 2 \cdot 236$, $\sqrt{6} = 2 \cdot 449$, $\sqrt{7} = 2 \cdot 646$, $\sqrt{8} = 2 \cdot 828$). 4

Or

Define interpolation. Write the underlying assumptions for the validity of the various methods used for interpolation.

5. *(a)* Deduce trapezoidal rule for numerical integration. 5

(b) Evaluate $\int_0^{10} x^2 dx$, by using Simpson's $\frac{1}{3}$ rule. 5

(c) Evaluate the integral of $f(x) = 1 + e^{-x} \sin 4x$ over the interval [0, 1] using Boole's rule (using exactly five functional evaluations). 5

Or

Use the midpoint rule with $M = 5$ to approximate the integral $\int_{-1}^{1} (1 + x^2)^{-1} dx$.

6. *(a)* Describe Euler's method for first-order and first-degree differential equation. 5

(b) Using the Runge-Kutta method of fourth order, find the numerical solution at $x = 0 \cdot 8$ for $\frac{dy}{dx} = x + y$, $y(0 \cdot 4) = 0 \cdot 41$, assume the step length $h = 0 \cdot 2$. 5

Or

Given $\frac{dy}{dx} = x^3 + y$, $y(0) = 1$, compute $y(0 \cdot 3)$ by Euler's method taking $h = 0 \cdot 1$.

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Total No. of Printed Pages—4

4 SEM TDC MTMH (CBCS) C 9

2022

(June/July)

MATHEMATICS

(Core)

Paper : C–9

(Riemann Integration and Series of Functions)

Full Marks : 80

Pass Marks : 32

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. *(a)* State two partitions of the interval [1, 2] such that one is a refinement of the other. 1

(b) Consider the function $f(x) = x$ on [0, 1] and the partitions

$$P = \{x_i = \frac{i}{4},\ i = 0, 1, 2, 3, 4\}$$

$$Q = \{x_j = \frac{j}{4},\ j = 0, 1, 2, 3, 4, 5, 6\}$$

Determine the lower sums and upper sums of f with respect to P and Q. State the relations between $L(f, P)$ and $L(f, Q)$; $U(f, P)$ and $U(f, Q)$. 4

Or

For a bounded function f on $[a, b]$ with its bounds m and M, show that

$$m(b-a) \leq L(f, P) \leq U(f, P) \leq M(b-a)$$

for any partition P of $[a, b]$.

2. *(a)* Define a tagged portion of a closed interval. Define Riemann sum of a bounded function. 1+1=2

(b) Let $f : [a, b] \to \mathbb{R}$ be integrable. Then show that

$$\left| \int_a^b f(x)dx \right| \leq \int_a^b |f(x)|dx$$ 3

(c) Answer any *four* questions from the following : 5×4=20

(i) Let $f : [a, b] \to \mathbb{R}$ be bounded and monotonic. Then show that f is integrable.

(ii) Let $f : [a, b] \to \mathbb{R}$ be continuous. Then show that f is integrable.

(iii) Let $f : [a, b] \to \mathbb{R}$ be integrable. Define F on $[a, b]$ as $F(x) = \int_a^x f(t)dt$; $x \in [a, b]$. Show that F is continuous on $[a, b]$.

(iv) Let f be continuous on $[a, b]$. Show that there exists $c \in [a, b]$ such that

$$\frac{1}{b-a}\int_a^b f(x)dx = f(c)$$

(v) Show that if $f : [a, b] \to \mathbb{R}$ is integrable, then $|f|$ is integrable on $[a, b]$.

(vi) Let $f : [a, b] \to \mathbb{R}$ be Riemann integrable. Then show that f is bounded on $[a, b]$.

3. *(a)* Discuss the convergence of $\int_1^\infty \frac{dx}{x^p}$ for various values of p. 3

(b) Attempt any *one* :
Show that—

(i) $B(m, n) = B(n, m)$

(ii) $\Gamma(m+1) = \underline{m}$; $m \in \mathbb{N}$ 3

(c) Show that $\int_0^\infty x^{n-1}e^{-x}dx$ exists. 4

4. *(a)* Define pointwise convergence of sequence of functions. 1

(b) Define uniform convergence of sequence of functions. 2

(c) State and prove Weierstrass M-test for the series of functions. 4

(d) State and prove Cauchy's criterion for uniform convergence of a series of functions. 4

Or

Let $f_n : J \subseteq \mathbb{R} \to \mathbb{R}$ converge uniformly on J to f. Let $f_n \; \forall n$ is continuous at $a \in J$. Then show that f is continuous at a.

(e) Let $\{f_n\}$ be a sequence of continuous functions on $[a, b]$ and $f_n \to f$ uniformly on $[a, b]$. Show that f is continuous and therefore integrable. Establish that

$$\int_a^b f(x)dx = \lim \int_a^b f_n(x)dx$$ 4

(f) Let $f_n : (a, b) \to \mathbb{R}$ be differentiable. Let there exist functions f and g defined on (a, b) such that $f_n \to f$ and $f_n' \to g$ uniformly on (a, b). Show that f is differentiable and $f' = g$ on (a, b). 5

(g) Consider the function $f_n : \mathbb{R} \to \mathbb{R}$ defined by $f_n(x) = \frac{\sin nx}{n}$. Show that (f_n) converges pointwise and uniformly to the zero function. 5

5. (a) Define a power series around a real number c. Give an example of power series around the origin. 1+1=2

(b) Define radius of convergence of a power series. Show that the radius of convergence R of a power series $\sum a_n x^n$ is given by $\frac{1}{R} = \lim \left| \frac{a_{n+1}}{a_n} \right|$. 4

(c) State and prove Cauchy-Hadamard theorem. 4

(d) Show that if the series $\sum a_n$ converges, then the power series $\sum a_n x^n$ converges uniformly on [0, 1]. 5

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Total No. of Printed Pages—7

4 SEM TDC MTMH (CBCS) C 10

2022

(June/July)

MATHEMATICS

(Core)

Paper : C–10

(Ring Theory and Linear Algebra—I)

Full Marks : 80

Pass Marks : 32

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. *(a)* Give an example of a ring without unity. 1

(b) Define unit element in a ring. 1

(c) If the unity and the zero element of a ring R are equal, show that $R = \{0\}$, where 0 is the zero element of R. 2

(d) Give an example of a subring which is not an ideal. 2

(e) If I is an ideal of a ring R with unity such that $1 \in I$, show that $I = R$. 2

(f) Show that $\mathbb{Z}_{12}$ is not an integral domain. 2

(g) Show that every field is an integral domain. Give an example to show that every integral domain is not necessarily a field. 4+1=5

Or

Define characteristic of a ring. Prove that the characteristic of an integral domain is 0 or a prime. 1+4=5

(h) Show that if A and B are two ideals of a ring R, then $A+B$ is an ideal of R containing both A and B, where

$$A+B = \{a+b \mid a \in A, b \in B\}$$ 5

Or

Show that in a Boolean ring R, every prime ideal $P \neq R$ is maximal. 5

2. (a) Define kernel of a ring homomorphism. 1

(b) If $f: R \to R'$ be a ring homomorphism, show that $f(-a) = -f(a)$. 2

(c) Let R be a commutative ring with char $(R) = 2$. Show that $\phi : R \to R$ defined by $\phi(x) = x^2$ is a ring homomorphism. 2

(d) Let

$$R = \left\{ \begin{bmatrix} a & b \\ b & a \end{bmatrix} : a, b \in \mathbb{Z} \right\} \text{ and } \phi : \mathbb{R} \to \mathbb{Z}$$

defined by

$$\phi\left(\begin{bmatrix} a & b \\ b & a \end{bmatrix}\right) = a - b$$

Find ker ϕ. 2

(e) Let $f: R \to R'$ be an onto homomorphism, where R is a ring with unity. Show that $f(1)$ is the unity of R'. 3

Or

Prove that a homomorphism $f : R \to R'$ is one-one if and only if ker $f = \{0\}$. 3

(f) Show that the relation of isomorphism in rings is an equivalence relation. 5

Or

Let A, B be two ideals of a ring R. Show that

$$\frac{A+B}{A} \cong \frac{B}{A \cap B}$$ 5

3. (a) Is $\mathbb{R}$ a vector space over $\mathbb{C}$? 1

(b) Define zero subspace of a vector space. 1

(c) For $x = (x_1, x_2)$ and $y = (y_1, y_2)$ of $\mathbb{R}^2$ and $\alpha \in \mathbb{R}$, let $x + y = (x_1 + y_1, x_2 + y_2)$ and $\alpha x = \alpha(x_1, x_2) = (\alpha x_1, 0)$. Is $\mathbb{R}^2$ a vector space with respect to above operations? Justify your answer. 1+1=2

(d) Let V be a vector space of all 2×2 matrices over the field $\mathbb{R}$ of real numbers. Show that the set S of all 2×2 singular matrices over $\mathbb{R}$ is not a subspace of V. 2

(e) Consider the vectors $v_1 = (1, 2, 3)$ and $v_2 = (2, 3, 1)$ in $\mathbb{R}^3(\mathbb{R})$. Find k so that $u = (1, k, 4)$ is a linear combination of v_1 and v_2. 2

(f) Show that the vectors $v_1 = (1, 1, 0)$, $v_2 = (1, 3, 2)$ and $v_3 = (4, 9, 5)$ are linearly dependent in $\mathbb{R}^3(\mathbb{R})$. 3

(g) Prove that any basis of a finite-dimensional vector space is finite. 4

Or

Let W_1 and W_2 be two subspaces of a finite-dimensional vector space. Then show that

$$\dim(W_1 + W_2) = \dim W_1 + \dim W_2 - \dim (W_1 \cap W_2)$$ 4

4. (a) Let T be a linear transformation from a vector space U to a vector space V over the field F. Prove that the range of T is a subspace of V. 3

(b) Examine whether the following mappings are linear or not : 2+2=4

(i) $T : \mathbb{R}^3 \to \mathbb{R}^2$ defined by

$$T(x, y, z) = (|x|, y + z)$$

(ii) $T : \mathbb{R}^2 \to \mathbb{R}^2$ defined by

$$T(x, y) = (x + y, x)$$

(c) If $T : \mathbb{R}^2 \to \mathbb{R}^3$ defined by

$$T(x, y) = (x + y, x - y, y)$$

is a linear transformation, find the rank and nullity of T. 4+4=8

(d) Let T be a linear operator on $\mathbb{R}^2$ defined by $T(x_1, x_2) = (x_1, 0)$. Find the matrix of T with respect to the basis $\{v_1, v_2\}$, where $v_1 = (1, 1)$ and $v_2 = (2, -1)$. 5

(e) Let $T : V \to U$ be a linear transformation. Show that

$$\dim V = \text{rank } T + \text{nullity } T \quad 5$$

Or

Prove that a linear transformation $T : V \to U$ is non-singular if and only if T carries each linearly independent subset of V onto a linear independent subset of U. 5

(f) Define isomorphism of vector spaces. Prove that the mapping

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \mapsto (a, b, c, d)$$

from $M_2(\mathbb{R})$ to $\mathbb{R}^4$ is an isomorphism. 5

Or

Prove that every n-dimensional vector space over a field F is isomorphic to F^n. 5

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4 SEM TDC CHMH (CBCS) C 8

2022

(June/July)

CHEMISTRY

(Core)

Paper : C–8

(Inorganic Chemistry)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Select the correct answer : 1×6=6

(a) The increasing order of the strength of the ligands I^-, CO, Cl^- and H_2O in the spectrochemical series is

(i) $I^- < H_2O < Cl^- < CO$

(ii) $Cl^- < I^- < H_2O < CO$

(iii) $I^- < Cl^- < H_2O < CO$

(iv) $I^- < Cl^- < CO < H_2O$

(b) Which of the following has the highest lability?

(i) SF_6

(ii) $[PF_5]^-$

(iii) $[SiF_6]^{2-}$

(iv) $[AlF_6]^{3-}$

(c) In the complex $[Ti(H_2O)_6]^{3+}$, the metal ion has

(i) d^1-configuration

(ii) d^2-configuration

(iii) d^3-configuration

(iv) d^5-configuration

(d) The common oxidation state shown by transition elements is

(i) +2

(ii) +3

(iii) +4

(iv) +5

(e) The number of $4f$-electron in lanthanum is

(i) 0

(ii) 1

(iii) 2

(iv) 5

(f) Non-heme iron protein is

(i) myoglobin

(ii) haemoglobin

(iii) cytochrome P450

(iv) hemerythrin

UNIT—I

2. Answer the following questions : 2×4=8

(a) What are labile and inert complexes? Give examples. 1+1=2

(b) Write the IUPAC names of the following compounds : 1+1=2

(i) $[Co(NH_3)_5SCN]Cl_2$

(ii) $K_3[Co(CN)_5NO]$

(c) Write the formula of the following compounds : 1+1=2

(i) Dichlorobis(triphenylphosphine) palladium (II)

(ii) Potassium pentachloronitrido-osmate (VI)

(d) Write the name and formula of each of the following types of ligand : 1+1=2

(i) A bidentate ligand with one acidic and one neutral donor

(ii) A tridentate ligand with three neutral donors

3. Answer any *two* questions : 3×2=6

(a) What do you mean by crystal field stabilization energy (CFSE)? Calculate CFSE for each of the following octahedral systems in Dq units : 1+1+1=3

(i) d^5-high spin

(ii) d^6-low spin

(b) $[Ni(CO)_4]$ is tetrahedral while $[Ni(CN)_4]^{2-}$ ion is square planar. Explain in the light of valence bond theory. 1½+1½=3

(c) Define stereoisomerism. Discuss the stereoisomerism exhibited by the complex ion $[Co(en)_2Cl_2]^+$. 1+2=3

4. Answer any *two* questions : 4×2=8

(a) What is the basis of crystal field theory? Draw the splitting patterns for octahedral, tetrahedral and square planar complexes in a crystal field. 1+3=4

(b) On the basis of CFT, calculate the spin only magnetic moment value (μ_s) for $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$ ions. 2+2=4

(c) For the $[Cr(H_2O)_6]^{2+}$ ion, the mean pairing energy (P) is found to be 23500 cm^{-1}. The magnitude of Δ_0 is 13900 cm^{-1}. Calculate the CFSE for the complex in both high spin and low spin states. 2+2=4

UNIT—II

5. Answer any *three* questions : 3×3=9

(a) Give reasons—

(i) Ti^{4+} ion is more stable than Ti^{3+} ion;

(ii) *d*-block elements show variable oxidation states. 1½+1½=3

(b) The decrease in the radius of elements Na(Z = 11) to Cl(Z = 17) is 0·55 Å, while the decrease for Sc(Z = 21) to Zn(Z = 30) is only 0·13 Å.

Explain the above data. 3

(c) Explain the Latimer and Bsworth diagram to account the stability of various oxidation states and e.m.f. 3

(d) Write all possible oxidation states exhibited by the elements of the first row transition series. 3

6. Find out the numbers of unpaired electrons and calculate the spin only magnetic moment value for the following ions : 2+2=4

(a) Fe^{2+}

(b) Mn^{2+}

UNIT—III

7. Answer any *two* questions : 2×2=4

(a) What are the consequences of lanthanide contraction?

(b) Sm^{2+} is a good reducing agent and Ce^{4+} is a good oxidizing agent. Explain.

(c) What are the problems in the separation of lanthanides from one another?

UNIT—IV

8. Answer any *two* questions : 4×2=8

(a) What is the essential element present in haemoglobin? How does it help in oxygen transport and storage? 1+3=4

(b) Explain the role of sodium and potassium ions in biological system. 2+2=4

(c) How does lead harm the human body? How can lead poisoning be prevented? 2+2=4

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4 SEM TDC CHMH (CBCS) C 9

2022

(June/July)

CHEMISTRY

(Core)

Paper : C–9

(Organic Chemistry)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following : 1×4=4

(a) Naphthalene when reduced with sodium and isoamyl alcohol gives

(i) 1,4-Dialin

(ii) 1,2-Dialin

(iii) tetralene

(iv) decalene

(b) The hybridization of nitrogen atom in piperidine is

(i) sp

(ii) sp^2

(iii) sp^3

(iv) unhybridized

(c) The fundamental unit in terpenes is

(i) 1,3-Butadiene

(ii) 2-Methyl-1,3-butadiene

(iii) allene

(iv) 1,2-Butadiene

(d) Which one of the following is not an alkaloid?

(i) Nicotine

(ii) Ephedrine

(iii) Adrenaline

(iv) Quinine

2. Answer any *four* questions from the following : 2×4=8

(a) Explain and arrange the following in increasing order of basicity :

(i) $CH_3CH_2NH_2$

(ii) CH_3CONH_2

(iii) $C_6H_5CONH_2$

(b) How will you prepare benzene-diazonium chloride? What happens when benzenediazonium chloride is treated with KCN?

(c) Explain why naphthalene is more reactive than benzene.

(d) Why is the electrophilic substitution in furan and other five-membered heterocycles are not carried in acidic medium?

(e) What is the structural formula of nicotine and hygrine?

UNIT—I

3. Answer any *three* questions : 3×3=9

(a) How would you distinguish among 1°, 2° and 3° amines with the help of Hinsberg test? 3

(b) Write short notes on any *two* of the following : 1½×2=3

(i) Gabriel phthalimide synthesis

(ii) Mannich reaction

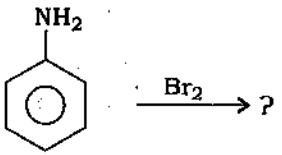
(iii) Carbylamine reaction

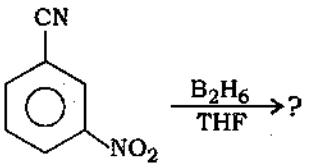
(c) Discuss the synthesis of the following : 1½×2=3

(i) Phenol from benzenediazonium chloride

(ii) *p*-Bromotoluene from *p*-toluidine

(d) Complete the following reactions (any *three*) : 1×3=3

(i) 

(ii) 

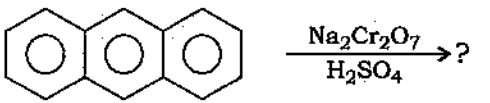
(iii) $RCH_2CH_2NO_2 \xrightarrow{573\ K} ?$

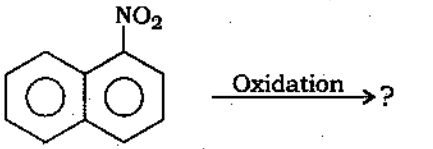
(iv) $N_2^+\bar{C}HCOOC_2H_5 + CH_2{=}CH_2 \longrightarrow ?$

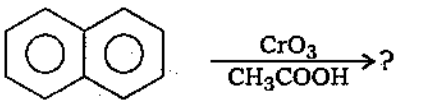
UNIT—II

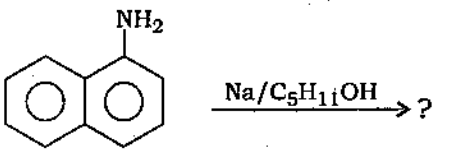
4. Answer any *three* questions : 3×3=9

(a) Complete the following reactions (any *three*) : 1×3=3

(i) 

(ii) 

(iii) 

(iv) 

(b) Explain why, α substitution in naphthalene is more suitable than β substitution on monosubstitution. 3

(c) How will you convert any *two* of the following? 1½×2=3

(i) Benzene into naphthalene

(ii) Anthracene into alizarin

(iii) Naphthalene into β-naphthol

(d) Write one method for the preparation of α-naphthol. How does it react with ammonia? 2+1=3

UNIT—III

5. *(a)* Which is more basic, pyrrole or pyridine? Explain. 2

(b) Starting with pyrrole, how will you get the following? 1+1=2

(i) 2-Nitropyrrole

(ii) 2-Formylpyrrole

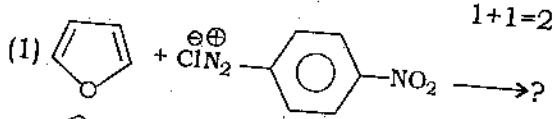
(c) Explain electrophilic substitution in pyrrole takes place at 2-position whereas in pyridine at 3-position. 3

(d) Answer any *three* questions : 2×3=6

(i) Give Skraup's synthesis of quinoline.

(ii) What happens when quinoline is oxidized with alkaline $KMnO_4$ and indole is treated with dimethylamine? 1+1=2

(iii) Complete the following reactions : 1+1=2



(iv) Convert the following : 1+1=2

(1) Thiophene from *n*-Butane

(2) 3-Nitropyridine from pyridine

(Continued)

UNIT—IV

6. *(a)* What are alkaloidal reagents? Give examples. 1+1=2

Or

Give the medicinal use of hygrine and reserpine. 1+1=2

(b) Describe in detail Hofmann exhaustive methylation method. 3

Or

Give one method of synthesis of nicotine. 3

UNIT—V

7. What is isoprene rule? Explain with example. Outline the synthesis of citral. 1+1+3=5

Or

What are terpenoids? How are they classified? Outline the synthesis of α-terpineol. 1+1+3=5

★★★

4 SEM TDC CHMH (CBCS) C 10

2022

(June/July)

CHEMISTRY

(Core)

Paper : C–10

(Physical Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following : 1×4=4

(a) The relation between equivalent conductance (Λ_e) and molar conductance (Λ_m) for $Al_2(SO_4)_3$ is

(i) $\Lambda_e = \Lambda_m$

(ii) $\Lambda_e = \frac{1}{2}\Lambda_m$

(iii) $\Lambda_e = \frac{1}{3}\Lambda_m$

(iv) $\Lambda_e = \frac{1}{6}\Lambda_m$

(b) E° values of $Mg^{2+}|Mg$, $Zn^{2+}|Zn$ and $Fe^{2+}|Fe$ are $-2{\cdot}37$ V, $-0{\cdot}76$ V and $-0{\cdot}44$ V respectively. Which of the following statements is correct?

(i) Mg^{2+} oxidises Fe

(ii) Zn oxidises Fe^{2+}

(iii) Zn reduces Mg^{2+}

(iv) Zn reduces Fe^{2+}

(c) The ionic mobility for alkali metal ions in aqueous solution is maximum for

(i) Na^+

(ii) K^+

(iii) Rb^+

(iv) Li^+

(d) The molecular dipole moment of chlorobenzene is 1·69 D. The dipole moments of *o*-, *m*- and *p*-dichlorobenzenes are

(i) 1·69 D, 2·93 D and 0 respectively

(ii) 0, 2·93 D and 1·69 D respectively

(iii) 2·93 D, 1·69 D and 0 respectively

(iv) 1·69 D, 2·69 D and 1·69 D respectively

2. Answer any *four* of the following questions : 2×4=8

(a) The standard reduction potential of $Cu^{2+}|Cu$ and $Cu^{2+}|Cu^+$ are 0·337 V and 0·153 V respectively. Calculate the standard electrode potential of $Cu^+|Cu$ half-cell.

(b) What is cell constant? How is it determined?

(c) Distinguish between an electrolytic cell and a galvanic cell.

(d) Why does the variation of equivalent conductivity on dilution of a strong electrolyte differ from that of a weak electrolyte?

(e) How do you account for the fact that the dipole moment of ethyl bromide (2·05 D) is considerably larger than that of chlorobenzene (1·70D)?

3. Answer any *two* of the following questions : 7×2=14

(a) (i) Explain clearly what is meant by Wien effect and Debye-Falkenhagen effect. 2+2=4

(ii) The specific conductance of a $0{\cdot}01$ mol dm^{-3} aqueous acetic acid solution at 298 K was $1{\cdot}65\times10^{-2}$ S m^{-1}. The equivalent conductance of acetic acid at infinite dilution was $390{\cdot}7\times10^{-4}$ S m^2 mol^{-1}. Calculate the degree of ionization (α) and the ionization constant (K_a) of the acid. 3

(b) (i) A decinormal solution of $AgNO_3$ was electrolyzed between platinum electrodes. After passing a small current for 2 hours, a fall of concentration of $5{\cdot}124\times10^{-4}$ gm equivalent occurred in the anodic solution. The mass of copper deposited in a copper coulometer placed in series was found to be 0·0388 gm. Calculate the transport number of silver and nitrate ions in silver nitrate ($AgNO_3$). (Equivalent mass of Cu = 31·8) 4

(ii) Discuss how the measurement of conductance can be applied to determine the solubility of a sparingly soluble salt. 3

(c) (i) Draw the curve showing the variation of conductance when acetic acid solution is titrated with sodium hydroxide solution and explain the reasons of such variation. 2+2=4

(ii) Derive the relation between ionic mobility and molar ionic conductance. 3

4. Answer any *two* of the following questions : 7×2=14

(a) (i) Derive a relation between the electromotive force and the equilibrium constant of a cell reaction. 3

(ii) What is the potential of the cell containing two hydrogen electrodes as represented below? 3

$$Pt, H_2(g) \left| H^+ (10^{-8}\ M) \right\| H^+ (0{\cdot}001\ M) \left| H_2(g), Pt \right.$$

(iii) How will pH of aq. NaCl solution be effected when it is electrolyzed? 1

(b) (i) Cu does not dissolve in HCl but in HNO_3. Explain. 2

(ii) Which alkali metal is the most powerful reducing agent in aqueous solution and which halogen is the strongest oxidizing agent? 2

(iii) Discuss the cell construction and cell reactions of standard hydrogen electrode. State whether this electrode is reversible with respect to H_2 gas or H^+ ions. 2+1=3

(c) (i) The Gibbs' free energy for decomposition of Al_2O_3 at 500 °C is as follows :

$$\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2$$

$$\Delta G = -966 \text{ kJ mol}^{-1}$$

Calculate the potential difference needed for electrolytic reduction of Al_2O_3. 3

(ii) What are concentration cells? Derive an expression for the e.m.f. of a concentration cell without transference. 3

(iii) What do you mean by standard electrode potential? 1

(d) (i) Metal rod *A* is dipped in 0·1 *M* solution of AsO_4. The salt is 95% dissociated at this dilution at 298 K. Calculate the electrode potential. Given $E^\circ_{A^{2+}|A} = -0{\cdot}76$ V. 3

(Continued)

(ii) Calculate K_c for the cell reaction

$$4Br^- + O_2 + 4H^+ \rightarrow 2Br_2 + 2H_2O;$$

$$E^\circ_{cell} = 0{\cdot}16 \text{ V}$$ 2

(iii) "Daniell cell is a reversible cell." Justify the statement. 2

5. Answer any *two* of the following questions : 5×2=10

(a) (i) Define any *two* of the following : 1×2=2

(1) Electronic polarization

(2) Atomic polarization

(3) Orientation polarization

(ii) Stating all the terms involved, write the suitable form of Clausius-Mossotti equation. Explain why this equation is applicable for non-polar molecules and not for polar molecules. 1½+1½=3

(b) Define paramagnetic and diamagnetic substances on the basis of their values of magnetic susceptibility and intensity of magnetization. The dipole moment of HCl molecule is 1·03D and it is 17% ionic. Find its bond distance. 2+3=5

$$\left[\begin{array}{l} e = 1{\cdot}60 \times 10^{-19} C \\ = 4{\cdot}8 \times 10^{-10} \text{ esu} \end{array}\right]$$

(Turn Over)

(c) What is magnetic susceptibility? What is the relation between magnetic susceptibility and magnetic moment? Explain. What is the SI unit of magnetic susceptibility? 2+2+1=5

6. Answer any *one* of the following questions : 3

(a) Discuss Gouy's method for determination of magnetic susceptibility of a substance.

(b) The dielectric constant of nitrogen at NTP is 1·004 and also its density is 1·25 gm/litre. Calculate the induced molar polarization and polarizability of the molecule.

(c) Calculate the liquid junction potential associated with the following cell at 25 °C :

$$Ag\,(s),\ AgCl\,(s),\ HCl\ (m_1 = 1{\cdot}0,\ \gamma_1 = 0{\cdot}809)\,||\,HCl\ (m_2 = 0{\cdot}05,\ \gamma_2 = 0{\cdot}830),\ AgCl\,(s),\ Ag\,(s)$$

If the transference number of H^+ is 0·83.

★★★